

Chemistry 129
Acids Worksheet

Click on *halogenated acetic acids*.

- 1) What is the K_a of acetic acid? Would you classify acetic acid as a strong or as a weak acid? ($K_a > 10$ for a strong acid).

$$K_a = 1.74 \times 10^{-5}$$

$$K_a \ll 1$$

Acetic acid is a weak acid.

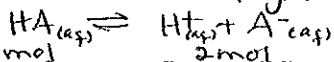
- 2) Write down the K_a expression. Move the bar with the initial concentration from 0.001M to 10M. How does the % dissociation change? Does this make sense when you consider the K_a expression?

$$K_a = \frac{[C_2H_3O_2^-][H_3O^+]}{[HC_2H_3O_2]}$$

* The pH of the solution decreases with increasing $[HA]_{initial}$ because $[H_3O^+]_{equil.}$ increases

* The % dissociation decreases with increasing $[HA]_{ini}$

* If we dilute a weak acid solution originally @ equilibrium, the system (according to Le Chatelier's principle) responds to minimize the disturbance. Thus, the equilibrium shifts to the right because the right side contains more particles in solution.



So, % dissociation is greater in a more dilute solution.

- 3) Record the K_a values for monofluoro, difluoro and trifluoroacetic acid by clicking on one *H* after the other. What are the trends?

acid	K_a
CH_2FCOOH	2.19×10^{-3}
CHF_2COOH	5.75×10^{-2}
CF_3COOH	5.89×10^{-1}

As the number of F atoms increases, the strength of the acid increases.

- 4) Click on all the *F* and turn them into *Cl*. What is the K_a of trichloroacetic acid? Is trichloroacetic acid weaker or stronger than trifluoroacetic acid? Click on the *Cl* and turn them into *H* and record the K_a for dichloroacetic acid and monochloroacetic acid.

acid	K_a
$CH_2ClCOOH$	1.38×10^{-3}
$CHCl_2COOH$	5.13×10^{-2}
CCl_3COOH	2.24×10^{-1}

- 5) Summarize the general trends for these acetic acid derivatives.

As the number of more electronegative atoms increases, the strength of the acid increases.

- 6) Go back to the menu and click on *Inorganic Oxyacids*. Take a *Cl* and put it in the place for the central atom. Add an *OH*, record the name and the K_a of the acid. Add three *O* one after the other and record the names and the K_a s.

Formula	Name	K_a
ClOH	hypochlorous acid	2.95×10^{-8}
OCIOH	chlorous acid	1.05×10^{-2}
O ₂ ClOH	chloric acid	1.00×10^3
O ₃ ClOH	perchloric acid	1.00×10^{10}

- 7) Clear the acid and put *S* in the place for the central atom. Add two *OH* groups and one *O*. Record the name and the K_a for the acid. Add another *O* to the acid. Record the name and the K_a .

Formula	Name	K_a
H ₂ SO ₃	sulfurous acid	1.26×10^{-2}
H ₂ SO ₄	sulfuric acid	1.00×10^3

- 8) Put *P* in the place of the central atom and replace one *O* with *OH*. Record the name and the K_a .

Formula	Name	K_a
H ₃ PO ₄	phosphoric acid	7.11×10^{-3}

- 9) Make *N* the central atom, and take away two *OH*. Record the name and the K_a of the acid. Add one *O* and record the name and the K_a of the acid.

Formula	Name	K_a
HNO ₂	nitrous acid	5.13×10^{-4}
HNO ₃	nitric acid	2.00×10^1

- 10) Based on the data above, how many oxygens without hydrogen are necessary to make an acid a strong acid?

Two oxygen atoms without hydrogen are needed to make an acid strong.